



**National Aeronautics and
Space Administration**

July 23, 1999

NRA-99-OES-04

RESEARCH ANNOUNCEMENT

**INVESTIGATIONS THAT CONTRIBUTE TO
THE NASA EARTH SCIENCE ENTERPRISE'S
MODELING AND DATA ANALYSIS RESEARCH
(with Revised Appendix D)**

**Letter of Intent Due August 26, 1999
Proposals Due September 27, 1999**

OMB Approval No. 2700-0087

**INVESTIGATIONS THAT CONTRIBUTE TO
THE NASA EARTH SCIENCE ENTERPRISE'S
MODELING AND DATA ANALYSIS RESEARCH**

**NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
September 27, 1999**

**NRA 99-OES-04
Issued July 23, 1999**

**Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546**

NASA RESEARCH ANNOUNCEMENT

Investigations That Contribute to the NASA Earth Science Enterprise's Modeling and Data Analysis Research

The NASA Earth Science Enterprise:

NASA's Earth Science Enterprise seeks to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. NASA is particularly focused on questions to which remote sensing data are essential for progress. Considering the current state of Earth science and the context of national and international research efforts, NASA has identified the following priority research themes for the coming decade:

- **Ecosystems & Global Carbon Cycle:** How do changes in terrestrial and marine ecosystems affect primary productivity and the global carbon budget?
- **Global Water & Energy Cycle:** In what way are atmospheric and hydrological processes that produce severe weather, cause floods, and control water resources related to climate changes?
- **Climate Variability & Change:** Are the changes we observe in the Earth climate associated with mechanisms we can understand, model, and predict?
- **Atmospheric Chemistry:** Is stratospheric ozone recovering as a result of the Montreal Protocol? Can long-distance transport cause significant global tropospheric pollution?
- **Solid Earth & Natural Hazards:** Can we understand the dynamics of the Earth interior, and use this knowledge to prepare for natural hazards such as volcanoes and earthquakes?

NASA Research Announcements (NRA'S) from the Earth Science Enterprise, as well as observing mission selections, are designed and issued in this broader research context. NRA's address specific elements of one of these themes, or address interdisciplinary research involving two or more of these (often involving related disciplines), or address modeling or other activities essential to progress in any of them.

This NASA Research Announcement:

NASA is soliciting proposals for investigations that will contribute to modeling and data analysis research that is supported by NASA's Earth Science Enterprise. This NRA solicits proposals directed to the interests of disciplinary research and analysis, interdisciplinary science, and data analysis programs that include global and regional modeling activities and large-scale data analysis, especially model-driven analysis. It also solicits proposals from instrument science teams and/or guest investigators being newly competed or re-competed in which global and regional modeling and/or model-driven data analysis constitute major elements of the proposal.

The Research Division of the Office of Earth Science supports research in climate modeling, including global atmospheric, oceanic, sea-ice, and coupled numerical modeling, land surface hydrological modeling and its coupling to the atmosphere, modeling of atmospheric chemistry and its linkage to atmospheric dynamics, model based data assimilation, and diagnostic analysis of model output and model assimilated data sets. The goal of NASA's modeling and data analysis research is to develop and use models and model-assimilated data sets to assess global and regional variability and trends in climate and other environmental parameters on seasonal through century time scales. More accurate analyses, simulations, and predictions with models and model assimilated data sets will have potentially large payoffs for many socioeconomic interests in the United States and elsewhere. Please refer to **Appendix A** for a more detailed description of the research areas covered by this NRA and the types of proposals being solicited.

In keeping with overall NASA goals and those of the Office of Earth Science, research supported by this NRA will be directed toward demonstrating successful use of data from satellite observing systems, in conjunction with other kinds of data, to improve models and assimilation systems for the Earth system or one or more of its components.

This NRA is supportive of the research objectives of the Climate Variability and Predictability (CLIVAR) Program, the Global Energy and Water Cycle Experiment (GEWEX), the Stratospheric Processes and their Role in Climate (SPARC) Program, the International Global Atmospheric Chemistry (IGAC) Program, and the Carbon Cycle Science (CCS) Initiative when objectives of these national and international programs correspond to those of this announcement.

This NRA will be open to all scientific investigators who submit proposals that are consistent with the objectives of NASA's modeling and data analysis research, as detailed in Appendix A, and that meet other requirements that are listed in Appendices B through F. Awards will be made for a period of three years to projects that are approved under the terms of this announcement. Individual awards are not expected to exceed \$200,000 per year for disciplinary research or \$800,000 for interdisciplinary research activities. Funding for this NRA is anticipated but has not yet been appropriated. NASA reserves the right to cancel this NRA if adequate funds are not appropriated.

Participation in this program is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers, and other U.S. agencies. In accordance with NASA policy as described in Appendix C, all investigations by foreign participants will be conducted on a no-exchange-of-funds basis, i.e., investigators whose home institution is outside the United States cannot be funded by NASA. Proposals may be submitted at any time during the period ending **September 27, 1999**. NASA reserves the optional right to consider proposals received after that date in accordance with Appendix B, paragraph 11, i.e., "the selecting official deems the late proposal to offer significant technical advantage or cost reduction." Proposals submitted to NASA will be evaluated using scientific peer review. Proposals selected for funding will be announced during November, 1999.

All prospective proposers are strongly encouraged to submit a letter of intent (LOI) to propose to this Announcement by **August 26, 1999**. This letter should contain a brief description of the research to be proposed. Please use electronic LOI submittal where possible; see Appendix E for details. Otherwise, hard copy or fax will be acceptable.

Technical information contained in Appendix A applies to this Research Announcement only. Appendices B through D contain NASA general guidelines for the preparation of proposals solicited by this Research Announcement. Appendix E gives information for electronic submittal of a letter of intent, and Appendix F contains instructions for preparing a budget summary.

Identifier:	NRA 99-OES-04
Submit Letter of Intent to:	MDAR Code Y 400 Virginia Avenue, SW, Suite 700 Washington, DC 20024
Submit Proposals to:	MDAR Code Y 400 Virginia Avenue, SW, Suite 700 Washington, DC 20024
Number of Copies Required:	10
Selecting Official:	Director, Research Division Office of Earth Science NASA Headquarters
Obtain Additional Information From:	Dr. Kenneth H. Bergman NASA Headquarters, Code YS

300 E Street, SW
Washington, DC 20546
Telephone: (202) 358-0765
FAX: (202) 358-2770
email: kbergman@hq.nasa.gov

Please use identifier number NRA-99-OES-04 when making an inquiry regarding this Announcement. Your interest and cooperation in participating in this effort are appreciated.

ORIGINAL SIGNED BY

Dr. Ghassem Asrar
Associate Administrator
Office of Earth Science

**NASA RESEARCH ANNOUNCEMENT
INVESTIGATIONS THAT CONTRIBUTE TO THE NASA
GLOBAL MODELING AND ANALYSIS PROGRAM**

**APPENDIX A: TECHNICAL DESCRIPTION AND SPECIFIC GUIDELINES FOR THIS
NRA**

1. Purpose of this NRA
2. NASA Programmatic Areas Included in this NRA
 - a. Global Modeling and Analysis Program (GMAP)
 - b. Atmospheric Chemistry Modeling and Analysis Program (ACMAP)
 - c. Physical Oceanography Research and Analysis Program (PORAP)
 - d. Ocean Vector Winds Science Team (OVWST)
 - e. Pathfinder Data Set and Associated Science Program (PDSP)
 - f. Modeling and Data Analysis in the EOS Interdisc. Science Pgm. (EOSIDS)
3. Guidance for Proposers

**APPENDIX B: INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH
ANNOUNCEMENTS (NRA)**

1. Foreward
2. Policy
3. Purpose
4. Relationship to Award
5. Conformance to Guidance
6. NRA-Specifications
7. Proposal Contents
8. Renewal Proposals
9. Length
10. Joint Proposals
11. Late Proposals
12. Withdrawal
13. Evaluation Factors
14. Evaluation techniques
15. Selection for Award
16. Cancellation of NRA

APPENDIX C: NASA GUIDELINES FOR FOREIGN PARTICIPATION

APPENDIX D:

1. Proposal Cover Sheet

2. Certifications, Disclosures, and Assurances Regarding Lobbying, Debarment and Suspension, and Drug-Free Workplace Requirements

APPENDIX E: LETTER OF INTENT

APPENDIX F: BUDGET SUMMARY

APPENDIX A TECHNICAL DESCRIPTION AND SPECIFIC GUIDELINES FOR THIS NRA

1. Purpose of this NASA Research Announcement

The purpose of this NASA Research Announcement is to solicit support for scientific research investigations in global and regional modeling of the Earth system, system components, and related data analysis activities. These research activities are supported through several disciplinary research programs (see below), the Pathfinder Data Set Program, and the EOS Interdisciplinary Science Program. Each of these individual programs has specific research goals and requirements that form part of NASA Earth Science overall goals, objectives, and requirements in global modeling and data analysis.

Proposers should direct their proposals to one of the individual research programs that are described below by so indicating in a cover letter. The proposal should also include a justification of why it addresses the objectives and research priorities of that program. Proposals received will generally be assigned to the program indicated by the proposer but may be reassigned if another program is deemed more appropriate. In some cases, proposals may be assigned to two programs for consideration if the proposal subject matter is related to both programs. Proposers will be notified about any reassignments. Proposals will be peer-reviewed using mail and/or panel reviewers, at the discretion of the program manager for each of the research areas below. Disciplinary sub-panels may be formed to evaluate proposals in specific disciplinary areas. All proposals in a single category as defined in this NRA will be evaluated by the same process, i.e., using a combination of mail and panel review.

All proposers are strongly encouraged to submit a letter of intent (LOI, see Appendix E) by the LOI due date of **August 26**.

This NRA is expected to result in research funding of \$65 million over three years. (Funding for the Ocean Vector Winds Science Team will extend to a fourth year.) A summary of the program elements participating in this NRA follows:

<u>Program Element</u>	<u>Manager</u>
a. Global Modeling and Analysis Program (GMAP)	K. Bergman
b. Atmos. Chemistry Modeling and Analysis Pgm. (ACMAP)	J. Kaye
c. Physical Oceanography Research and Analysis Pgm. (PORAP)	E. Lindstrom
d. Ocean Vector Winds Science Team (OVWST)	E. Lindstrom
e. Pathfinder Data Set and Associated Science Pgm. (PDSP)	J. Dodge
f. EOS Interdisciplinary Science Program (EOS/IDS)	J. Dodge

2. NASA Programmatic Areas Included in this NRA

a. Global Modeling and Analysis Program (GMAP):

The Global Modeling and Analysis Program (GMAP), a research program in NASA's Office of Earth Science (OES), supports ongoing research in physical climate variability and change on all time scales. The overall goal and objectives of GMAP are the following:

Overall Program Goal:

Develop and use models and model-assimilated data sets to assess global climate system variability and trends on seasonal through century time scales.

Program Objectives:

- Develop, improve, and test global atmospheric climate models and their couplings to models of other parts of the Earth system, and use them to diagnose and predict climate variations and trends, with the objective of providing analytic and predictive capability for assessments of global climate and Earth system behavior.
- Develop, improve, test, and assist in implementing a near-real-time model-driven data assimilation system that will have the capability of ingesting Earth Observing System (EOS) and other remotely sensed observational data along with conventional data, with the objective of providing the best possible synthesis of observational information and model skill, in the form of research quality climate data sets, for community use.

GMAP supports research in global modeling and in model-based data assimilation, with a primary focus on modeling and assimilation of atmospheric variables but also including coupling of atmospheric general circulation models (AGCM's) to other component models of the climate system. The major research activities at NASA Centers supported by GMAP are longer time-scale modeling and climate trend simulation at the Goddard Institute for Space Studies (GISS), seasonal-to-interannual modeling and experimental prediction of climate variability at the Goddard Space Flight Center (GSFC), primarily through the NASA Seasonal to Interannual Prediction Project (NSIPP), and model-based data assimilation of atmospheric and land surface data by the Data Assimilation Office (DAO), also at GSFC. GMAP also supports other research efforts at NASA Centers, universities, and other institutions, that are collaborative with or complementary to these major research activities. GMAP is supportive of research that contributes to the goals of the Climate Variations (CLIVAR) and the Global Energy and Water Experiment (GEWEX) international research programs.

In keeping with overall NASA goals and those of the Office of Earth Science, research supported by GMAP is directed toward demonstrating successful use of data from satellite observing systems, in conjunction with other kinds of data, to improve climate models and assimilation systems. Examples of satellite data sets that have the potential to improve the performance of

climate models and data assimilation systems include existing data products from TRMM, SAGE, TOMS, UARS, ERBE, NSCAT, and SeaWifs as well as new satellite data sets such as those from QuikSCAT and Terra when they become available.

GMAP is soliciting proposals from the broader scientific community that will contribute to the overall GMAP goal and objectives given above. Proposals are especially sought for efforts that will contribute in a collaborative or complementary sense to the three major NASA research activities mentioned above. Submitted proposals should address use of appropriate space based data in climate modeling and data assimilation development and application research. Proposals intended for GMAP should address one or more of the following programmatic research priorities:

- Global model development and improvement, including model numerics, dynamical cores, radiation algorithms, and coupling of atmospheric GCM with other climate system components, for climate system research and for dynamic data assimilation.
- Development and testing of parameterizations of physical, chemical, and biological processes in models, proceeding from existing process-oriented models and algorithms, such as those developed through process oriented field experiments (e.g. BOREAS, LBA, FIRE, SHEBA, etc.), to representations suitable for global climate system models.
- Development of improved methodologies for dynamic four-dimensional model-based data assimilation, including objective analysis methods based on Kalman filter theory, efficient data quality control procedures, dynamic initialization of assimilating model, variable grid procedures for regional-scale assimilation, and ingestion of new kinds of space-based observations.
- Diagnostic and predictive studies of the global climate using models and model-assimilated data sets, including evaluation of model performance, evaluation of assimilated data sets, evaluation of the impact of new kinds of remotely sensed data, use of assimilated data sets to study climate system energetics and climate trends and variations, and use of climate system models together with data sets to simulate past climate and predict future climate states.

Total funds available for research proposals selected under this portion of the announcement are approximately \$4.2 M over three years and are expected to support several proposals in the range of \$50,000 to \$200,000/yr. Funding will be distributed among the four research elements above based on the quality of proposals received. Priority will be given to proposals that clearly justify how the proposed effort supports objectives of the NASA Earth Science Enterprise, that use remotely sensed data sources, and that are collaborative with ongoing modeling activities supported by NASA.

Investigators are encouraged to discuss possible proposals with the responsible manager of GMAP, Dr. Kenneth H. Bergman, at 202-358-0765 or kbergman@hq.nasa.gov.

b. Atmospheric Chemistry Modeling and Analysis Program (ACMAP):

The primary objective of ACPMAP is to study the distribution of trace constituents in the global troposphere and stratosphere through the use of computational models and the analysis of spatially and temporally extended data sets. ACPMAP also supports the bulk of NASA's studies of stratospheric meteorology, and of the dynamical, chemical, and radiative couplings between the Earth's stratosphere and troposphere as well as the stratosphere and upper atmosphere (mesosphere/thermosphere). Efforts within ACPMAP emphasize the global atmosphere, although some consideration is given to the large regional (continental and hemispheric) scales; ACPMAP does not support studies at local scales. ACPMAP only supports proposals in the areas of data analysis, interpretation, and modeling. *ACPMAP does not support proposals for laboratory work or field measurements.*

Current research in ACPMAP may be broken down into several categories. A listing of these categories, together with brief descriptions and their approximate fraction of ACPMAP in FY98 follow:

- *Stratospheric Dynamics and Related Data Analysis (20%):* Modeling and data analysis studies of temperature and wind distributions of the stratosphere, transport processes in the stratosphere, and their long-term evolution, as well as dynamical couplings between the stratosphere and regions below (troposphere) and above (mesosphere).
- *Atmospheric Chemistry Data Analysis (30%):* Analysis of satellite and aircraft data on the trace constituent composition of the troposphere and stratosphere, including both short- and long-term variations, as well as re-examination of existing data sets. Data sets of greatest interest are NASA satellite missions and atmospherically-oriented aircraft missions (the stratospherically oriented AAOE, AASE I, AASE II, SPADE, ASHOE/MAESA, STRAT, VOTE/TOTE, POLARIS, and the tropospherically-oriented Global Troposphere Experiment series of campaigns, as well as missions supported by NASA's Atmospheric Effects of Aviation Project, such as SUCCESS and SONEX).
- *Aerosols, Stratospheric Clouds, and Radiation (10%):* Studies of the combined physical and chemical processes by which aerosols and polar stratospheric clouds form in the atmosphere and of the optical and chemical effects they have on radiative transfer in the troposphere-stratosphere system, including ultraviolet radiation at the Earth's surface
- *Multi-Dimensional Atmospheric Modeling (35%):* Studies of tropospheric and stratospheric chemistry using two- and three-dimensional models, emphasizing the simulation of the combined effects of chemical and transport properties on atmospheric chemistry; evaluation of models using ground-, aircraft-, and space-based data forms an important part of these efforts. Increasing emphasis has been placed recently in the improved representation of the chemical

effects of aerosols on tropospheric trace constituents. Some consideration is given to the combined effects of atmospheric chemistry and climate change.

The remaining part of ACMAP (~5%) goes towards program infrastructure, meetings, student support, and general support of activities which enhance the research effectiveness of principal investigators (PIs) within the program.

ACMAP is only one of several NASA programs supporting modeling and analysis of atmospheric trace constituent measurements. Other NASA programs active in this area include the Interdisciplinary Science Program of the Earth Observing System (EOS), the Upper Atmosphere Research Satellite (UARS) Guest Investigator Program, the Total Ozone Mapping Spectrometer (TOMS) and the Stratospheric Aerosol and Gas Experiment (SAGE II) Science Teams. Some modeling activities are also carried out under the Upper Atmosphere Research Program and the Tropospheric Chemistry Program of OES. The research supported by ACMAP contributes in a significant way to several elements of the Stratospheric Processes and their Role in Climate (SPARC) program of the World Climate Research Program and the International Global Atmospheric Chemistry (IGAC) program of the International Geosphere-Biosphere Programme (IGBP).

The full range of NASA's research in the area of atmospheric ozone, including plans for future evolution of this research, is described in the Atmospheric Ozone section of the *Mission to Planet Earth Science Research Plan*. This document is available electronically at <http://www.earth.nasa.gov/visions/draftsciplan/mtpe-srp.htm>. The broader context of NASA's Earth Science Enterprise program may be found in the *Earth Science Strategic Enterprise Plan*, which is available at <http://www.earth.nasa.gov/visions/stratplan/index.html>.

The intention is to maintain support within ACMAP for each of the above areas, and submission of new or renewal proposals in any of them is invited.

However, the research areas for which new and/or redirected renewal proposals are most desired are as follows:

- The study of dynamical, chemical, and/or radiative processes by which stratospheric processes affect the troposphere. Such studies may use a data analysis and/or a modeling perspective. They may be focused on the present atmosphere, although consideration of how these couplings may have changed in the past or may change in the future would certainly be appropriate. All proposals should involve detailed specification of potential mechanisms for downward-propagating effects and, where appropriate, a means for testing hypothesized mechanisms
- The consideration of the effects of global atmospheric change on the chemistry of the troposphere through the use of multi-dimensional atmospheric chemistry/transport models. The background changes of greatest interest are both global climate change and global chemical change; changes in land cover or land use that could have implications for global tropospheric

chemistry are also of interest, however. Potential changes in all levels of the troposphere may be proposed in this area. Proposals should be global or near-global in scope; proposals focused on limited geographical regions are of much less interest than those at larger spatial scales. Proposals that combine the use of models with data sets, or explain how model results can be tested with data likely to be available are particularly encouraged.

- The incorporation of multi-dimensional models, satellite data, and meteorological forecasting and analysis capability into multi-national and/or multi-agency field campaigns, especially airborne experiments, focused on improving our understanding of the chemistry of the free troposphere and/or stratosphere. Development of computational models to be used in this work should not be proposed here, however; it is expected that any proposals offered in this area will come from groups with models at an appropriate stage of development. Proposals for theory and modeling support for NASA-sponsored airborne missions (e.g. SAGE Ozone Loss and Validation Experiment, Pacific Exploratory Mission – PEM Tropics B, etc.) is not appropriate here, as there have been separate NRAs for those. The present element is clearly designed for broadly-based, multi-sponsor missions. One example is the suggested Aerosol Characterization Experiment (ACE) Asian mission planned for 2001, but proposals for other broadly-based multi-sponsor missions are equally welcome.

Approximately \$6M is available over 3 years (~\$2M/year) for ACMAP as part of this solicitation. Most tasks selected will be in the \$75,000 - \$150,000 range, with larger tasks typically being those that contribute significantly to major assessments such as those sponsored by the World Meteorological Organization and United Nations Environment Programme or the Intergovernmental Panel on Climate Change. Priority will be given to proposals that clearly justify how the proposed effort supports objectives of the NASA Earth Science Enterprise, that use remotely sensed data sources, and that are collaborative with other research activities supported by NASA.

Contact point for ACMAP is Dr. Jack Kaye; phone: 202-358-0757; fax: 202-358-2770; or e-mail: jkaye@hq.nasa.gov.

c. Physical Oceanography Research and Analysis Program (PORAP):

The Physical Oceanography Program supports basic research and analysis activities to enable development of NASA's current and future satellite missions and the scientific interpretation of data from them. The primary centers of support within the Physical Oceanography Program are at the NASA Goddard Space Flight Center Laboratory for Hydrospheric Processes, the NASA Jet Propulsion Laboratory Earth Science Directorate, and the academic community through grants to Universities.

The primary scientific thrust for physical oceanography at NASA is toward understanding the ocean's role in climate variability and its prediction. Since the general ocean circulation plays a

critical role in the global heat balance and materially changes atmospheric properties through air-sea exchange, fundamental understanding and modeling the state of the coupled ocean-atmosphere system is fundamental to climate studies. NASA utilizes the unique vantage point of space to enable rapid collection of global ocean data sets and intends to contribute significantly the World Climate Research Program's Climate Variability and Predictability (CLIVAR) Program.

An emerging area of increased emphasis in NASA's Oceanography Program is research on the coastal ocean. While NASA's focus will remain global in nature, it is recognized that the practical problems of man's interaction with the ocean lie within the coastal seas.

Six themes are identified in the Physical Oceanography program and represent priority areas for proposals sought in this announcement. The six areas are:

- g. Analysis and interpretation of ocean circulation using satellite, aircraft and in situ data:

The program jointly supports, with NSF, proposals submitted for synthesis of results from the World Ocean Circulation Experiment (WOCE). In addition to WOCE synthesis, the present announcement seeks modest proposals to the Physical Oceanography Program undertaking analysis of satellite altimetry, surface wind stress, and other relevant data in support of the CLIVAR Program. Theoretical developments in the area of longer time-scale coupled atmosphere-ocean modes of variability are also sought to catalyze future data analyses. Analyses with emphasis on coastal circulation would also be of interest.

- h. Development and demonstration of ocean data assimilation techniques:

NASA supports the development and realization of the Global Ocean Data Assimilation Experiment (GODAE). Demonstration oceanographic products of the highest scientific quality are sought as pathfinders for future operational services and ocean observation requirements.

- i. Improved numerical simulation of the ocean circulation:

Fundamental to long-term climate prediction is the ability to efficiently and effectively model the global ocean circulation. Preference will be given to model development work arising from direct comparison of numerical simulations with satellite-derived global ocean or ocean-basin-scale data sets. Nesting of higher resolution coastal models within lower resolution open-ocean simulations is a proposition consistent with an emerging programmatic interest in coastal seas.

- j. Basic research on fundamental characteristics of the sea surface:

Active areas of support include analysis of the wave field and surface roughness, skin temperature, and salinity. Laboratory experiments and modest in situ or airborne

observing missions can be supported as components of such research, but their cost should not exceed 25 percent of the total proposed effort.

k. Understanding and estimation of air-sea fluxes

The ability to make global estimates of air-sea fluxes of heat, freshwater, momentum, and gases are fundamental to our capability to predict long-term climate variations.

Development of methodologies to powerfully utilize remotely sensed properties of the sea surface to determine fluxes are sought.

l. Providing the scientific basis for next generation ocean remote sensing technologies.

Priority areas presently supported include GPS reflections phenomenology, surface salinity remote sensing, and optical sounding of the ocean with lasers. Program support is confined primarily to theoretical development of physics and signal processing.

Instrument development is the subject of separate program announcements from NASA Headquarters.

Total funds available for work selected under this portion of the announcement are approximately \$6M over three years. Money will be distributed across the six research themes based on the quality of proposals received. Proposals outside these themes may be considered, but must be highly competitive.

Programmatic priority will be given to those proposals making the strongest links to analysis of satellite data and addressing oceanographic problems at basin or global scale.

Contact point for the Physical Oceanography Program is Dr. Eric Lindstrom, 202-358-4540, fax 202-358-2770, elindstr@hq.nasa.gov

d. Ocean Vector Winds Science Team (OVWST):

Building on the legacy of the NASA Scatterometer (NSCAT) Science Team and the SeaWinds Science Team, NASA seeks to select a team of investigators for analysis and interpretation of ocean vector winds and other applications derived from upcoming scatterometer-equipped earth-observing missions. NASA is scheduled to launch the QuikSCAT satellite instrumented with the SeaWinds scatterometer in June 1999. This instrument is a copy of the dual conically scanning pencil beam, Ku-band, SeaWinds scatterometer instrument that will also fly on NASDA's ADEOS-2 mission planned for launch in November 2000.

The QuikSCAT mission is designed specifically to acquire accurate, extensive, high resolution near-surface vector wind measurements over the global oceans. QuikSCAT will acquire global backscatter cross-section measurements at 47 degree (H-pol) and 55 degree (V-pol) incidence angles, with 12-35 km resolution. Vector winds will initially be processed at 25 km resolution

over a 1400-1600 km wide continuous swath (no nadir gap). Post-launch work conducted by the instrument science and engineering teams will quantitatively characterize the accuracy of high resolution vector wind products. Prelaunch simulations indicate that the 25 km winds will meet or exceed science requirements (2 m/s or 10% rms speed accuracy, 20 deg. rms directional accuracy for the chosen ambiguity) over virtually the entire measurement swath. QuikSCAT will therefore cover 90% of the ice-free global oceans daily. (Following the launch of ADEOS-2 in November 2000, the combined QuikSCAT/ADEOS-2 scatterometers will achieve 90% coverage every 12 hours).

The existing SeaWinds Science Team will conduct basic algorithm/processing refinement and backscatter and vector wind validation studies, as well as preliminary scientific studies to demonstrate the scientific utility of the QuikSCAT data. The opportunity presented here is aimed at developing science team capabilities that can enhance and be merged with the existing SeaWinds Science Team. This merged team will become known as the NASA Ocean Vector Winds Science Team. Present SeaWinds Science Team members will retain their present support through the merger and renaming of the team and are not required to recompute under this announcement. The team leader for the Ocean Vector Winds Science Team will be Dr. Michael Freilich of Oregon State University and the Project Scientist will be Dr. Timothy Liu of the Jet Propulsion Laboratory.

NASA solicits additional scientific investigations that require the accurate and extensive vector wind and backscatter measurements to be provided by QuikSCAT and the combined QuikSCAT/ADEOS-2 SeaWinds scatterometers. Studies focusing on the following areas are particularly encouraged:

- 1) Construction and detailed analysis of regularly gridded space-time vector wind, vector wind stress, and dynamically important derivative fields from QuikSCAT and other co-orbiting instruments (e.g., the ERS-2 AMI instrument, ADEOS-2, etc.);
- 2) Determination and phenomenological/geographical characterization of small-scale, high frequency surface wind forcing scales of variability and their impact on a range of oceanographic, meteorological, and climate processes;
- 3) Scientific application of SeaWinds data for investigation of large-scale air-sea interaction and hydrological processes combination with additional remotely sensed data sets (e.g., SSMI, scatterometer, and TRMM data);
- 4) Interdisciplinary regional and basin-scale physical/biological interaction studies designed to determine the utility (and limitations) of remotely sensed, high resolution vector wind data for improving understanding of the role of wind forcing in determining upper ocean primary production and ecosystem evolution;

5) Development of advanced processing techniques and analyses designed to compare and/or combine data from co-orbiting active and passive microwave instruments to yield the most accurate wind estimates;

6) Determination of the utility and limitations of SeaWinds backscatter data for non-ocean applications, such as cryospheric investigations and moderate resolution vegetation mapping over land.

From this announcement, the Ocean Vector Winds Science Team will be selected for a period of four years beginning approximately January 1, 2000. The anticipated total funding to result from this competition is \$12M over four years. Additional science funding supports the SeaWinds team that will be merged with the newly selected investigators.

Cognizant Program Scientist at NASA Headquarters for the Ocean Vector Winds Science Team is Dr. Eric Lindstrom (202-358-4540, fax 202-358-2770, elindstr@hq.nasa.gov)

e. Pathfinder Data Set and Associated Science Program (PDSP):

NASA is soliciting proposals for continuing and new research associated with its Pathfinder Data Set Program.

Background:

The Pathfinder Data Set Program began in 1990 as a cooperative agreement between NASA and NOAA to help provide the infrastructure for scientific-quality interdisciplinary research of the Earth. The early goals were directed towards obtaining long-term, calibrated data sets from operational sensors. Several excellent data sets were produced from the TOVS, AVHRR, SSM/I, and GOES sensors. Care was taken to adhere to good data management practices, and the process was fully integrated with the early EOSDIS DAAC system for archiving of the final products in many useful formats.

In 1995, NASA added additional types of Pathfinder Data Sets and Algorithm Development and allowed for reprocessing of some earlier product sets and the development of new algorithms which might be the nucleus for future Pathfinder projects. This process brought in new research and data set production, including radar altimetry over polar ice, the Antarctic Mapping Project, reprocessing of oceanographic satellite altimeter data, combined analysis products of atmospheric ozone, enhancement of the ISCCP for GEWEX, surface radiation budget algorithms and data sets, a global study of layered cloud systems, a set of calibrated products from the GOES geostationary satellite series, a study of merging the geostationary data from GMS and GOES, and a long-term set of radiation products derived from METEOSAT.

Further NASA/NOAA efforts led to a Joint Program Announcement for Enhanced Data Sets for Analysis and Applications and resulted in excellent products such as a 20-yr. ice motion data set using data from buoys, AVHRR, ERS-1 SAR, and RADARSAT.

This announcement:

While this program in the past has stressed long, accurately-calibrated and validated data sets for studying primarily climate change, the program now is also focused on understanding critical interaction and feedback processes, including those of a physical, chemical, dynamic, or biological nature. In order to study these processes, a more regional focus is required, with combined data sets consisting of the available satellite and airborne remote sensing data plus relevant in situ data for tuning algorithms and validating results over wider areas being used. In this NRA, the Pathfinder data sets that are proposed may be collections of various types of data necessary to investigate a particular interaction process or feedback mechanism. This could include data obtained from U.S. Agencies, state and local sources, commercial suppliers or data collected directly from satellites including, when they become available, the transmissions from Terra, PM-1, NOAA satellites, ADEOS-II, or GEO satellites. This does not rule out the continuation of current or previous long-term global data sets; however, the scientific case must be made for the need to extend current data series. It is also important to stress that this is an opportunity which plans to support research beyond the scope of traditional individual disciplines and which is critically dependent upon the type, quality and extent of data now available for Earth Science research.

The focus of this NRA is both data analysis and modeling, thus the emphasis which this program has previously placed on data set production and analysis is now accompanied by an opportunity to use these data sets in the numerical evaluation of processes as well as the incorporation of combined data sets into models that will assess process or feedback importance, predict regional impacts, or forecast eventual long-term change. NASA has a significant 4-D model-based assimilation activity at the Goddard Space Flight Center, and data products could be developed that would be tested and evaluated through that mechanism. Otherwise, a proposer intending to conduct model studies should have access to an established modeling activity and the associated scientific experience in order to include modeling as a part of the proposed research. This portion of the NRA is not intended to support basic model construction or institutional support. It could, however, include support for a sufficient amount of programming to test and evaluate the data products for their impacts on model simulations or to explore interactions and feedback processes.

The problem of assuring measurement accuracy, especially during the transition from sensors on one spacecraft to those on another spacecraft, continues. Unlike the operational satellite series, the series of research satellites making the same types of measurements may not be the same instrument design, necessitating a period of data overlap, intercomparisons, and product validation. To a certain extent, this type of data set continuity evaluation and correction may still be proposed under this NRA; however, the real test of the value of the data or other derived

products is in their use for pathfinding research. Through this NRA, proposals are being sought which will explore new and important interdisciplinary interaction processes through the use of comprehensive data sets and regional modeling, as applicable. Relevant information on NASA's interdisciplinary research program is given in Section f.

Guidelines:

For the collection/acquisition/production/purchase of the required data for the proposed research, several concepts are encouraged:

- Integration of multiple data sets into special purpose data sets, especially space and non-space data sets.
- Development of long time series of related data products to quantify variability and trends.
- Special data sets that enable new approaches to calibration and validation.
- Higher levels of derived products, especially those that cut across traditional disciplines.

Some guidelines for the formation of data sets are as follows:

- Products or data collections should be based on publicly available data, not on the use of data which are not widely available to the scientific community (e.g., those that are in a "proprietary period" in which access is limited to selected investigators).
- Prior Pathfinder Projects can be continued or renewed if there is sufficient science justification.
- New sources of data can be utilized, including Web sources, commercial, foreign, and Earth Science Information Partners (ESIP's).

Recently, NASA has initiated a "Science Data Buy Program" as a part of its Commercial Remote Sensing Program (CRSP) at NASA's Stennis Space Center. Excellent land remote sensing data sets are available from five companies simply by confirming a requestor's requirements through an online proposal request, which is subsequently validated by NASA Headquarters Program Managers. Information on obtaining this data can be found at <http://www.crsp.ssc.nasa.gov/databuy>.

In addition to the proposal requirements set forth in Section 3 below and in Appendix B, proposals addressed to the Pathfinder Data Set and Associated Science Program should contain a description of, and justification for, the required data and chosen algorithms and a general statement of the likely outcome of a nominal 3-year research project. In the budget, costs for the acquisition, purchase, storage, and processing of data should be included as well as for any required ancillary or in situ data. Also, costs for regional modeling or impact evaluations to assess the implications of the proposed interdisciplinary process study can be included. Proposers should include one trip to the Washington, DC area for a Pathfinder Science Team Meeting.

NASA intends to fund this effort at the level of approximately \$3.5M/yr. for the next three years in order to support about 15-20 moderately sized proposals of from \$150-200K/yr. each.

Proposals for this section should be marked, "Pathfinder Data Sets and Associated Science". The coordinator for this program is Dr. James C. Dodge , Tel. (202)358-0763 , e-mail jcdodge@hq.nasa.gov .

f. Modeling and Data Analysis in the EOS Interdisciplinary Science Program (EOS/IDS):

NASA is soliciting proposals to renew current research or initiate new research in modeling and data analysis associated with the EOS Interdisciplinary Program. Current EOS/IDS investigators who plan to apply for future NASA funding to continue their research in the areas of modeling and data analysis should propose at this time even if their current funding continues beyond December 2000.

Background:

NASA solicited and selected several types of interdisciplinary grants to support the Earth Observing System (EOS) Program. They were primarily focused on understanding of interdisciplinary processes, algorithm development, on building the infrastructure to take full advantage of EOS data, especially from multiple sensors platforms, and on developing innovative data products. Prior to launch of EOS satellites, these investigations have made use of precursor data sets. Additional projects were selected in 1995 that focused on the use of space-based multispectral remotely sensed observations to study Earth System processes. Together, these interdisciplinary projects were intended to establish a scientific foundation and make progress toward developing interactively coupled Earth System models that capture atmosphere-ocean-ice and atmosphere-land-biosphere interactions across a range of space and time scales.

This announcement:

The current EOS Interdisciplinary Science (IDS) Program builds on past progress and involves data analysis, field programs, exploration of new research algorithms for the accurate measurement of new quantities, educational outreach, and practical applications. The focus of this NRA, for research to begin in FY2000, will be on data analysis and modeling, with an emphasis on furthering the understanding of interdisciplinary Earth System processes on regional to global scales. The models to be developed and the data analysis work to be carried out under the IDS program should make extensive use of remotely sensed data. IDS investigations may have a component of data-gathering through laboratory, ground-, aircraft-, or balloon-based measurements as needed for process understanding and model evaluation, or augmentation of otherwise available data sets, but the contribution of such data-gathering to the total scope of the effort should be fairly small.

The EOS IDS Program embraces the full range of scientific topics covered by the Earth Science Enterprise (ESE). The Science Implementation Plan currently being developed by ESE covers five scientific priorities: biology and biogeochemistry of ecosystems and the global carbon cycle, the global water and energy cycle, climate variability and prediction, atmospheric chemistry, and solid earth science. The plan also notes the importance of interdisciplinary science, as interesting and important science may not reside completely within a single disciplinary area. In fact, it is clearly recognized that many of the most interesting questions associated with the Earth as an integrated system occur specifically at the interface between the traditional disciplines. Examples include the relationship between atmospheric chemical change and climate change, the effect of long-term global climate change on the distribution of liquid water at the Earth's surface on local scales, and the effects of changes in global climate and atmospheric composition on the productivity of the terrestrial biosphere. The EOS IDS program is designed specifically to assure that science questions such as these, which cut across two or more of the traditional disciplines within Earth science, can be effectively addressed by the Earth science community.

This IDS NRA opportunity is, therefore, focused on investigations of a truly interdisciplinary nature that cut across the traditional disciplines in Earth science and, specifically, address the five scientific priorities identified above. The proposals submitted under this category of the NRA should have a firm scientific basis and should propose to study significant interdisciplinary science processes through use of data analysis and/or modeling at spatial scales from regional to global. The use of remote sensing data in analysis, model initialization, evaluation, or interpretation should be an important component of the proposed investigation. The data sources can include all relevant data for understanding the science, including EOS sensors, other NASA data sources, and those of other national and international organizations, as well as commercial entities from which data is available for purchase. Appropriate surface, airborne, and balloon data may also be used. As noted above, the proposals may include the gathering of some additional sub-orbital data, but such gathering should constitute no more than a minor part of the overall proposal.

Proposed research that emphasizes modeling and data analysis at regional to global scales and makes appreciable use of remotely sensed data will be considered as responsive and will be evaluated as part of this element of the NRA. In order to provide some guidance to proposers, several cross-disciplinary subjects, which are of known interest to NASA, are identified below. *It is emphasized that this list is by no means exhaustive, and that other innovative proposals that cross traditional disciplinary boundaries and address modeling and data analysis issues will be considered.*

Biogeochemical Processes: studies which provide insight into the ways in which carbon-containing compounds, especially methane and carbon dioxide, are exchanged among the atmosphere, soils, wetlands, plants, rivers, and the frozen land surface are desired. Studies which explore the relationship the role of the hydrologic cycle in determining the way in which carbon-containing species move through the environment are also desired. This element forms an

important component of NASA's plans to provide research on the global carbon cycle in support of the carbon cycle initiative of the US Global Change Research Program.

Surface Biogeochemistry: studies which provide insight into the way in which radiatively and chemically active trace gases are exchanged between the atmosphere and the biosphere are desired. Specific interest is given to understanding the role of the surface as a source and/or sink for a range of trace gases, notably nitrogen-, sulfur-, and halogen-containing gases that have natural sources or a combination of natural and anthropogenic sources (for carbon-containing gases this is covered in Chapter 1 for carbon dioxide and in the item above for methane). The role which fires have in affecting the fluxes of trace gases into the atmosphere is also of interest, as is the role which urban areas have in contributing to the distribution of intermediate and long-lived trace gases whose influence is felt over very large spatial scales. The role of urban areas on regional climate (e.g. urban heat island effects) is also of interest.

Atmospheric chemistry and climate: studies which provide improved understanding of the interactions between tropospheric and stratospheric chemical constituent transport and reactions and atmospheric circulation and climate changes on global and regional scales. This includes stratospheric ozone depletion as well as tropospheric aerosols and other pollutants and their effect on radiative balance and indirectly on circulation, and it includes analyzing and modeling transformation and transport processes for constituents in the global atmosphere and the interactions between atmospheric chemical constituents and biological productivity.

Coastal region processes: studies which provide insight into how changes in global climate, large scale industrialization, and large scale land use changes (including biomass burning or agricultural development) may affect the physical and biological state of coastal regions are desired. Changes in the distribution of extreme events, flux of material through rivers, sea level, and atmospheric deposition of nutrients are all of interest.

Air-sea interactions: studies of the way in which energy, water, and other chemicals are transferred across the ocean-atmosphere interface and the representation of this transfer process in global models are desired. Those studies that demonstrate the use of remotely-sensed data in the improved understanding and/or simulation of this process will be of most interest.

Land-climate feedback: studies of the way in which changes in land surface use can affect the physical climate (including the distribution of moisture, as well as that of temperature) at regional to global scales are desired. Studies of the inverse of this process – how climate change might be expected to change land usage are also desired. Among the land use changes of interest are suburbanization (sprawl), societal infrastructure development (highways), cultivation of new land areas, fires, receding glaciers. Those studies that freely allow for consideration of feedbacks will be of greatest interest.

Guidelines:

In addition to the proposal requirements set forth in Section 3 below and in Appendix B, proposers to the EOS/IDS program should include a general statement of the likely outcome of a nominal 3-year research project. Costs for the acquisition, purchase, storage, or processing of data should be included as well as for any required ancillary or in situ data. Also, costs for modeling, if proposed, should include all aspects of the process from writing software through computer operations and time.

Proposers to this section of the NRA should plan to make two trips yearly to coordinate their work with other NASA researchers conducting similar work. Traditionally, all of the EOS-IDS researchers meet yearly at a single location for approximately 3 days. A second meeting should also be planned that is more disciplinary in nature and is related to the primary discipline area of the proposal. For budgeting purposes, one may be considered an East coast trip and the other a West coast trip.

The amount of funding support for these activities initially will be approximately \$10M/yr. for a performance period of three years and later may increase to about \$15M/yr. Proposers should submit no more than three-year research proposals. NASA expects to fund around 5-7 grants in the \$700-800K/yr. range and about 20 grants in the \$250K/yr. range.

The overall coordinator of the EOS-IDS Program at NASA Headquarters is Dr. James Dodge, Tel. (202)358-0763, e-mail: jdodge@hq.nasa.gov.

3. Guidance for Proposers

General instructions for submission of a proposal in response to this announcement are given in **Appendix B**.

Please note carefully: in addition to the requirements of Appendix B, and any specific requirements in the relevant program sections above, proposals should provide the following information:

- A brief statement of relevancy for a selected disciplinary program, the Pathfinder Program, or the Interdisciplinary Science Program should be included on the abstract page or as a separate page. A proposal that the cognizant program manager determines is not relevant to the interests of that program or any of the other programs covered by this NRA will be returned to the proposer.
- A work plan, indicating the specific tasks that are planned for each year of the proposed project, should be included as part of the text.
- All proposals should include a list of other support for the principal investigator and any co-investigators. Where the proposers have other support from NASA's Office of Earth Science, a

clear statement of the relationship between this proposals and their other NASA funding should be provided.

- Vitae for each investigator should be limited to no more than three pages, including a selected list of publications.
- To facilitate recycling, proposals should be prepared on white paper using no binding material other than clips or staples. No plastic cover sheets should be used. If color figures are used, proposers should assure that all proposal copies contain color copies of the figures.
- Proposals should be self-contained. Preprints or reprints of publications and reports should not be attached. Reviewers will be instructed that they should ignore any such attachments when evaluating a proposal.
- If use of NASA supercomputer resources is anticipated, an estimate of computational requirements on a NASA system should be included as part of the budget submission.
- Costs for acquisition, storage, or processing of data should be included as well as for any required ancillary or in situ data. If any data are desired that could be made available through the “data buy” activity of NASA’s Commercial Remote Sensing Program (CRSP), this should be clearly stated. Direct purchase of data from commercial sources is permitted, but the full costs of such purchases should be included and documented in the proposal.
- To ensure adequate communications between investigators in selected programs, proposers should include in their plans one three-day program review each year. For budget purposes, assume that these meetings will alternate between East and West Coast locations.

Proposers are requested to be reasonably concise when writing a proposal. *The expository text, exclusive of references, vitae, budget information, and certifications, should not exceed 15 pages of single-spaced pica 12 type.* Reviewers will be informed that they need not consider any material in excess of this length limit. Proposals should be self-contained and should not make unnecessary reference to other materials. In particular, readers should *not* be directed towards websites on the internet.

Review of submitted proposals will be competitive. Proposals will be subject to both mail peer review and to the deliberations of a review panel. The responsible program manager reserves the right to negotiate revised budgets or work plans in light of the results of the review process. Funding will typically be in annual installments for a period of three years, subject to demonstrated satisfactory progress and continued availability of funds. Funding of successful proposals is expected to start early in calendar year 2000.

APPENDIX B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 1997)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items.

Several proposal submission items appear in the NRA itself or in **Appendix A**: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; unique proposal requirements for this NRA; and sources for more information.

(c) Required Items for all NRAs.

The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged,

place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach. NASA is required to post abstracts for selected proposals on its website home page. Therefore, abstracts should be written in a manner that can be understood by the intelligent layperson.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs.

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the

procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX C

NRA SOLICITATION PROVISION

FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION IN RESPONSE TO NASA RESEARCH ANNOUNCEMENTS

- (a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. participation must be endorsed by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.
- (b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations, Space Science and Aeronautics Division will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:
1. A letter of notification by NASA, and
 2. An exchange of letters between NASA and the sponsoring governmental agency; or
 3. A formal Agency-to-Agency Memorandum of Understanding (MOU).
- (c) As stated in Paragraph b. above, foreign proposals accepted under this NRA will be implemented on the customary no-exchange-of-funds basis in which NASA and the sponsoring foreign agency will each bear the cost of discharging their respective responsibilities. Additionally, NASA funding may not be used to purchase a launch service from a non-U.S. source. However, the direct purchase of goods and/or services from non-U.S. sources by U.S. Principal Investigators or U.S. Co-Investigators is permitted. Proposers are advised that international purchases must meet NASA and Federal regulations and that these regulations may place an additional burden on the successful proposer that should be explicitly included in discussions of the proposed budget.

APPENDIX D
Proposal Cover Sheet

NASA Research Announcement 99-OES-04

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Address	Telephone & Email
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ 4th Year: _____ Total: _____
(OVWST Only)

Program Element (*select one or more*)

- _____ Global Modeling and Analysis Program (GMAP)
- _____ Atmospheric Chemistry Modeling and Analysis Program (ACMAP)
- _____ Physical Oceanography Research and Analysis Program (PORAP)
- _____ Ocean Vector Winds Science Team (OVWST)
- _____ Pathfinder Data Set and Associated Science Program (PDSP)
- _____ EOS Interdisciplinary Science Program (EOS/IDS)

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and* (ii) *Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

**Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in
Federally Assisted Programs**

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX E

Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. A submission form for a letter of intent is available electronically via the Internet at URL: <http://www.earth.nasa.gov/LOI>. We urge you to use this electronic letter of intent form unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-2970 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX F

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimates for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

	A	 NASA USE ONLY 	
		B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs</u> :			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs</u> :	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any)	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. <u>Total Estimated Costs</u>	_____	_____	XXXXXXXX
9. APPROVED BUDGET	XXXXXXX	XXXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. Other Direct Costs:
 - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. Other Applicable Costs: Enter total explaining the need for each item.
5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the

anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.